Applications Note

Configuring the iSR6142 for FCIP

Products Affected

Product Name	Part Number
iSR6142	ISR6142-CK

1 Introduction

This applications note provides step-by-step instructions for connecting two Fibre Channel (FC) storage area networks (SANs) using the Fibre Channel over IP (FCIP) routing feature of the iSR6142. Throughout this applications note, the SANs are referred to as *local* and *remote*. The routers provide the inter-switch link (ISL) between the Fibre Channel switches, thus linking the Fibre Channel switches (SANs). The example used in this applications note links two Fibre Channel SANs for the purpose of data replication.

2 Simple Topology

Figure 2-1 shows how the iSR6142 routers, Fibre Channel switches, and two storage arrays are connected in a simple topology. For other configuration examples, see “Advanced Topologies” on page 9.

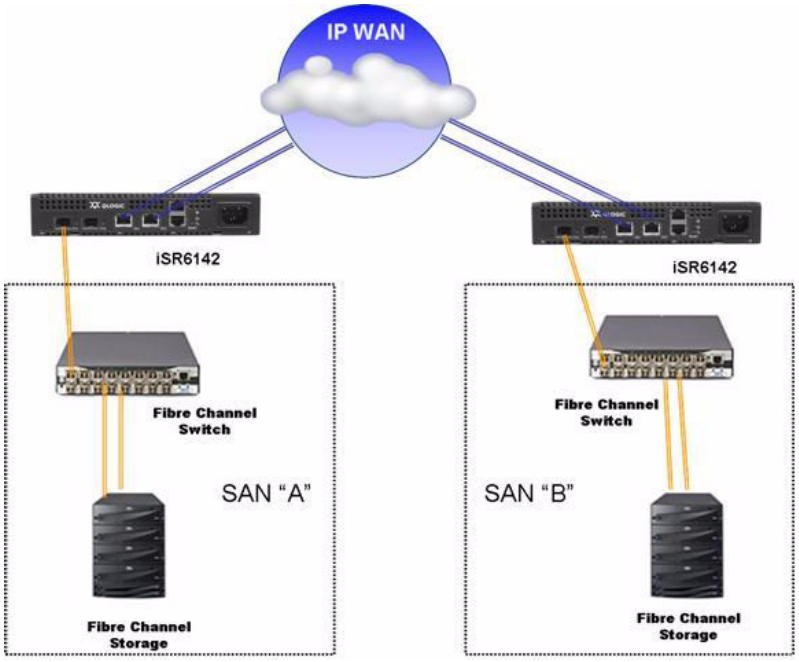

Figure 2-1. Single Gateway Topology

3
Configuration Steps

1. Gather the following information required to configure the iSR6142 routers (review the topology diagrams in this document):
   a. Local router management port:
      IP Address _____._____._____._____
      Subnet mask _____._____._____._____
      Gateway _____._____._____._____
   b. Remote router management port:
      IP Address _____._____._____._____
      Subnet Mask _____._____._____._____
      Gateway _____._____._____._____
   c. Local router gigabit Ethernet (GigE) ports to be used in FCIP connections:
      GE1 IP Address _____._____._____._____
      GE1 Subnet Mask _____._____._____._____
      GE1 Gateway _____._____._____._____
      GE2 IP Address _____._____._____._____
      GE2 Subnet Mask _____._____._____._____
      GE2 Gateway _____._____._____._____
   d. Remote router GigE ports to be used in FCIP connections:
      GE1 IP Address _____._____._____._____
      GE1 Subnet Mask _____._____._____._____
      GE1 Gateway _____._____._____._____
      GE2 IP address _____._____._____._____
      GE2 Subnet Mask _____._____._____._____
      GE2 Gateway _____._____._____._____
2. Install iSCSI/FC Router Manager (router management software) on your workstation.
3. Configure the iSR6142 routers:
   a. Set up the management IP address, subnet mask, and gateway.
   b. Set the time and date. The time and date are set up automatically when iSCSI/FC Router Manager connects to the router.

4. Configure FCIP routes from the QRouter command line interface (CLI) using a Telnet session or serial connection (see Figure 3-1) with the `fciproute add` command, or from iSCSI/FC Router Manager (see Figure 3-2).

```
QRouter (admin) #> fciproute add
A list of attributes with formatting and current values will follow.
Enter a new value or simply press the ENTER key to accept the current value.
If you wish to terminate this process before reaching the end of the list
press 'q' or 'Q' and the ENTER key to do so.

WARNING:
The following command might cause a loss of connections to both GE ports.

Configuring FCIP Route: 1
--------------------------
FCIP Interfaces FC & GE (0=Enable, 1=Disable) [Enabled         ]
FC Port (1=FC1, 2=FC2)                        [FC1             ]
GE Port (1=GE1, 2=GE2)                        [GE1             ]
IP Address                                    [0.0.0.0         ] 10.3.4.101
Subnet Mask                                   [0.0.0.0         ] 255.255.255.0
Gateway IP Address                            [0.0.0.0         ]
Remote IP Address                             [0.0.0.0         ] 10.3.4.100
Jumbo Frames (0=Enabled, 1=Disabled)          [Disabled        ]
TCP Window Size (0=8KB, 1=16KB, 2=32KB)       [32768           ]
Window Scaling (0=Enable, 1=Disable)          [Disabled        ]
TCP Port No. (Min=1024, Max=65535)            [3225            ]
GE Link Rate (0=Auto, 1=10Mb, 2=100Mb, 3=1Gb) [Auto            ]
FCIP Time Stamp (0=Enable, 1=Disable)         [Enabled         ]
Error Detect TimeOut (Min=1sec, Max=5sec)     [1               ]
Resource Allocate TimeOut (Min=1sec, Max=5sec)[1               ]
Bandwidth, Mbit/sec (Min=1, Max=1000)         [1000            ]
VLAN (0=Enable, 1=Disable)                    [Disabled        ]
FCIP SW Compression (0=Enable, 1=Disable)     [Disabled        ]

All attribute values for FCIP Route 1 will now be saved.
```

Figure 3-1. Configuring FCIP Routes from CLI

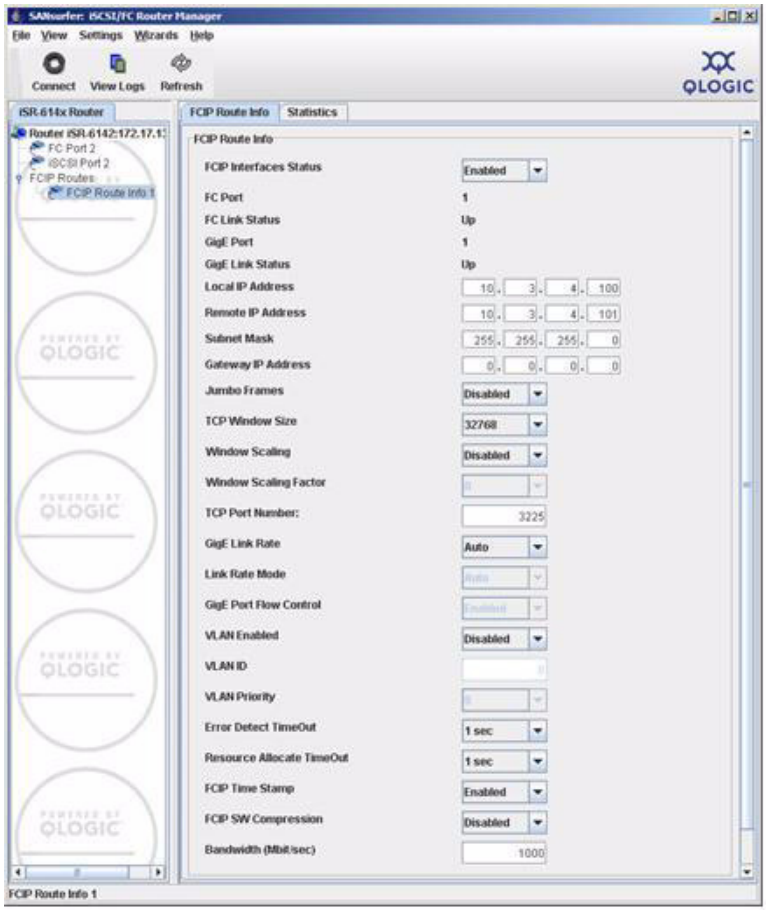

Figure 3-2. Configuring FCIP Routers from iSCSI/FC Router Manager

5. Configure the link rate on the Ethernet switches and routers. The router Gigabit Ethernet port and the Ethernet switch port should have matching link rate and duplex mode, as specified in Table 3-1. If the link rate and duplex mode are not set as specified inTable 3-1, then the end-to-end link will not be stable.

Table 3-1. Link Rates

Router GE Port		Ethernet Switch Port Connected to Router GE Port	
Duplex	**Link Rate**	**Duplex**	**Link Rate**
Auto	Auto	Auto	Auto
Full	Auto	Full	Auto
Full	100	Full	100
Full	1000	Full	1000

6. Configure the iSR6142 Ethernet performance:

   a. The TCP window size defines the maximum amount of data transmitted that was unacknowledged (see Table 3-2). The TCP window size is typically increased to compensate for distance (round trip delay) and link data rate. The *iSR6142 Intelligent Storage Router Installation Guide* (SN0051102-00) contains tables that provide configuration parameters for typical data rates and delays. The TCP window size configuration includes the following two parameters:

   - ❑ TCP max window size: 8192, 16384, 32768
   - ❑ Window scaling: 0 through 7

Table 3-2. TCP Maximum Window Size

TCP Window Size (bytes)	TCP Maximum Window Size	Window Scaling
8 K	8,192	0
16 K	16,384	0
32 K	32,768	0
64 K	32,768	1
128 K	32,768	2
256 K	32,768	3
512 K	32,768	4
1 M	32,768	5
2 M	32,768	6
4 M	32,768	7

   b. Bandwidth limiting:

   The Ethernet transmit bandwidth utilized by the router is configurable from 2 to 1000 Mbps (megabits per second). For example, if the WAN connection is capable of 45 MBps (megabytes per second), but you want to limit FCIP to 33 percent of the available bandwidth, set the router bandwidth parameter to 15 (15 = 45 x 33 percent).

CAUTION!

Do not set the bandwidth parameter higher than the available WAN bandwidth, otherwise performance will suffer due to WAN congestion (dropped packets).

   c. Compression:

   As a rule, compression should be set to `enable` when your Ethernet link data rate is less than 45 Mbps (5 MBps).

   d. Jumbo frames:

   Using jumbo frames will increase Ethernet efficiency. If used, jumbo frames must be enabled on both the Ethernet switches and the routers.

7. Verify the IP connection between the local and remote routers using the router's ping feature through the QRouter CLI (see Figure 3-3) or iSCSI/FC Router Manager (see Figure 3-4). Verify all IP connections: management, GE1, and GE2.

```
QRouter (admin) #> ping

A list of attributes with formatting and current values will follow.
Enter a new value or simply press the ENTER key to accept the current value.
If you wish to terminate this process before reaching the end of the list press
'q' or 'Q' and the ENTER key to do so.

IP Address                                [0.0.0.0] 10.3.4.101
Iteration Count (Min=1, Max=10)           [10     ] 3
Outbound Port (0=Mgmt, 1=GE1, 2=GE2)      [Mgmt   ] 1

Pinging 10.3.4.101 with 32 bytes of data:

Reply from 10.3.4.101: bytes=32 time=0.2ms
Reply from 10.3.4.101: bytes=32 time=0.1ms
Reply from 10.3.4.101: bytes=32 time=0.1ms

Ping Statistics for 10.3.4.101:
Packets:  Sent  = 3, Received = 3, Lost = 0
Approximate round trip times in milli-seconds:
Minimum = 0.1ms, Maximum = 0.2ms, Average = 0.1ms
```

Figure 3-3. Ping with CLI

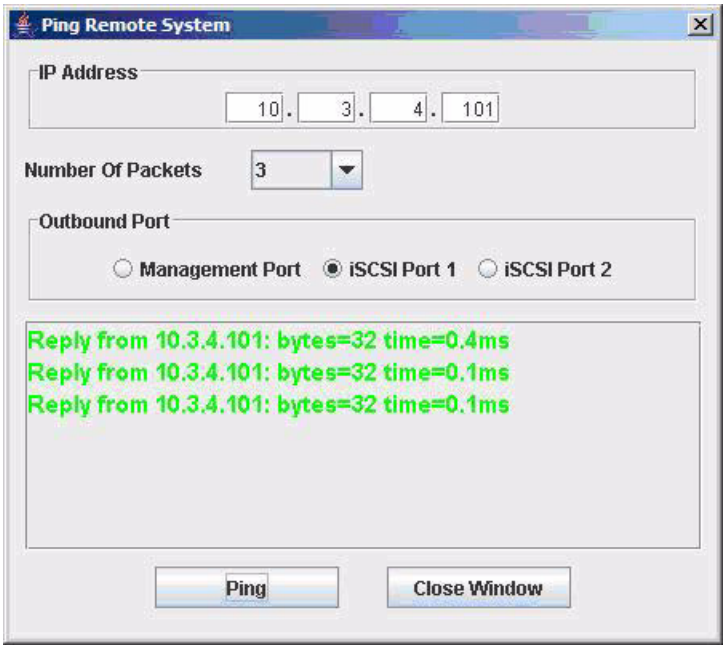

Figure 3-4. Ping with iSCSI/FC Router Manager

NOTE:

Both the QRouter CLI and iSCSI/FC Router Manager have an option to choose the outbound port (management, iSCSI1/GE1, or iSCSI2/GE2), packet count, and destination IP address. Pinging the remote router's IP addresses from the local router verifies that the router ports can communicate with each other.

8. Connect the iSR6142 routers to the Fibre Channel switches:

NOTE:

The Fibre Channel switches must be switches from the same manufacture and must be compatible. The switch ports connected to the router may need to be set to E_Port (expansion port). The FCIP link between the Fibre Channel switches becomes an ISL; consequently, the switches are merged (SANs). For the ISL to function correctly, the switches must be in auto-domain ID mode, or have been assigned different domain IDs. In addition, the zone names on the switches must be unique; the switches cannot have identical zone names before connecting the routers.

a. If the Fibre Channel switch is from Brocade, then the switch port connected to the routers must have its port ISL mode set to enable `R_RDY` mode, as shown in Figure 3-5.

```
B4100:admin> portCfgISLMode
Usage: portCfgISLMode PortNumber Mode
Mode: 1 - Enable ISL R_RDY Mode on port
      0 - Disable ISL R_RDY Mode on port
This operation not applicable on VE/VEX_Ports.

B4100:admin> portCfgShowgenerate /remove trace dump or display
Ports of Slot 0    0  1  2  3   4  5  6  7    8  9 10 11    12 13 14 15
-----------------+--+--+--+--+----+--+--+--+----+--+--+--+----+--+--+--
Speed             AN AN AN AN   AN AN AN AN   AN AN AN AN   AN AN AN AN
Trunk Port        ON ON ON ON   ON ON ON ON   ON ON ON ON   ON ON ON ON
Long Distance     .. .. .. ..   .. .. .. ..   .. .. .. ..   .. .. .. ..
VC Link Init      .. .. .. ..   .. .. .. ..   .. .. .. ..   .. .. .. ..
Locked L_Port     .. .. .. ..   .. .. .. ..   .. .. ON ..   .. .. .. ..
Locked G_Port     .. ON .. ..   .. .. .. ..   .. .. .. ..   .. .. .. ..
Disabled E_Port   .. .. .. ..   .. .. .. ..   .. .. ON ..   .. .. .. ..
ISL R_RDY Mode    ON ON .. ..   .. .. .. ..   .. .. ON ..   .. .. ON ..
RSCN Suppressed   .. .. .. ..   .. .. .. ..   .. .. .. ..   .. .. .. ..
Persistent Disable.. .. .. ..   .. .. .. ..   .. .. .. ..   .. .. .. ..
NPIV capability   ON ON ON ON   ON ON ON ON   ON ON ON ON   ON ON ON ON
uRouteConfig            Configure a static route
Ports of Slot 0   16 17 18 19   20 21 22 23   24 25 26 27   28 29 30 31
-----------------+--+--+--+--+----+--+--+--+----+--+--+--+----+--+--+--
Speed             AN AN AN AN   AN AN AN AN   AN AN AN AN   AN AN AN AN
Trunk Port        ON ON ON ON   ON ON ON ON   ON ON ON ON   ON ON ON ON
Long Distance     .. .. .. ..   .. .. .. ..   .. .. .. ..   .. .. .. ..
VC Link Init      .. .. .. ..   .. .. .. ..   .. .. .. ..   .. .. .. ..
Locked L_Port     .. .. .. ..   .. .. .. ..   .. .. .. ..   .. .. .. ..
Locked G_Port     .. .. .. ..   .. .. .. ..   .. .. .. ..   .. .. .. ..
Disabled E_Port   .. .. .. ..   .. .. .. ..   .. .. .. ..   .. .. .. ..
ISL R_RDY Mode    .. .. .. ..   .. .. .. ..   .. .. .. ..   .. .. .. ..
RSCN Suppressed   .. .. .. ..   .. .. .. ..   .. .. .. ..   .. .. .. ..
Persistent Disable.. .. .. ..   .. .. .. ..   .. .. .. ..   .. .. .. ..
NPIV capability   ON ON ON ON   ON ON ON ON   ON ON ON ON   ON ON ON ON

                  where AN:AutoNegotiate, ..:OFF, ??:INVALID.
```

Figure 3-5. Setting the Brocade Switch Port ISL Mode to Enable

b. Connect the local router to the local Fibre Channel switch.

c. Connect the remote router to the remote Fibre Channel switch.

The FCIP route establishment may take up to one minute after connecting the Fibre Channel interfaces.

d. Verify the router-to-switch Fibre Channel connectivity:

- ❑ On the Fibre Channel switches, the port connected to the router should appear as an E_Port.
- ❑ On the routers, verify the connectivity using the CLI or iSCSI/FC Router Manager. When using the GUI, remember to refresh the display.

The Fibre Channel switches should now show an ISL between each other. Most Fibre Channel switch user interfaces have a topology display that shows the ISL (see Figure 3-6).

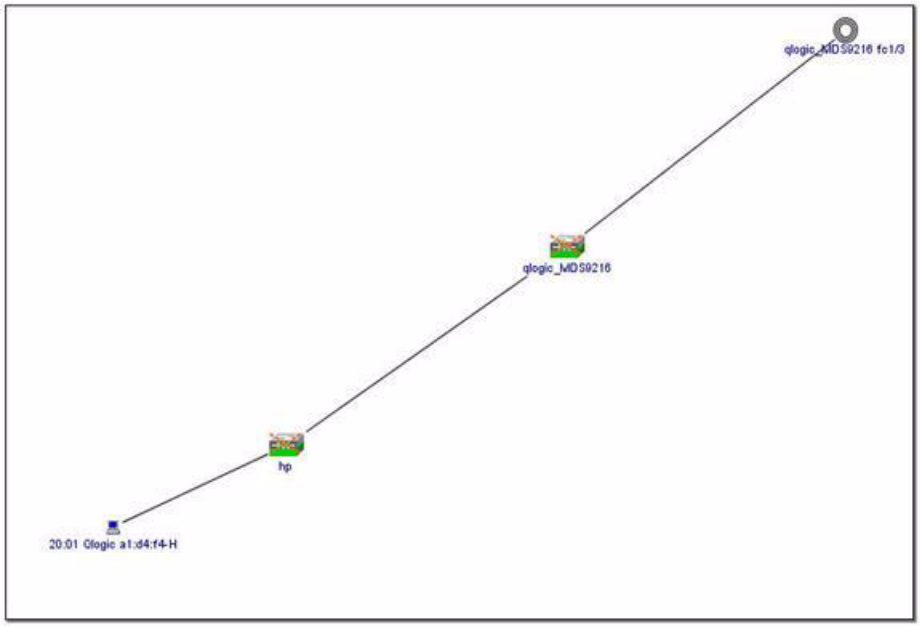

Figure 3-6. Fibre Channel Switch Topology with ISL

9. Fibre Channel switch zoning is affected when the Fibre Channel switches are linked by an ISL (merged). Review your switch zoning and correct any inconsistencies.

The purpose of the FCIP route example in this applications note is to provide data replication between the two storage arrays. Therefore, after the FCIP route (ISL) is established, you must zone together the storage array ports used for data replication.

You have successfully completed installation of the iSR6142 and configuration of an FCIP route.

4 Advanced Topologies

The drawings in this section illustrate several more advanced topologies for multiple routes.

Figure 4-1 shows how a Fibre Channel switch with a single E_Port can simply route all Fibre Channel frames bound for any non-local device out of the known E_Port.

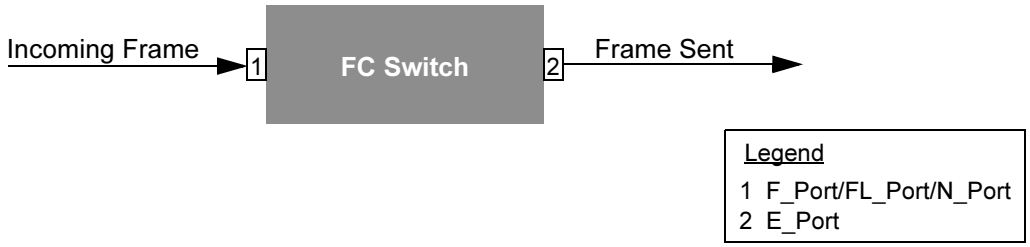

Figure 4-1. Single E_Port

Figure 4-2 shows how a Fibre Channel switch with more than one online E_Port must determine from which E_Port an incoming Fibre Channel frame is routed (sent) out.

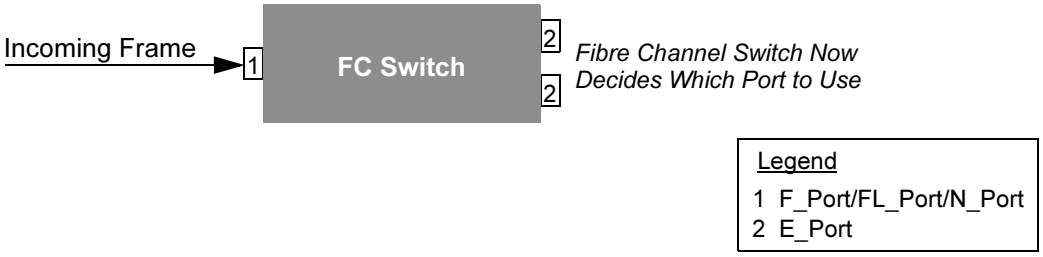

Figure 4-2. Dual E_Ports

Figure 4-3 shows a simple, single E_Port topology between two non-high availability (HA) SANs. All FCIP traffic flows across this single link.

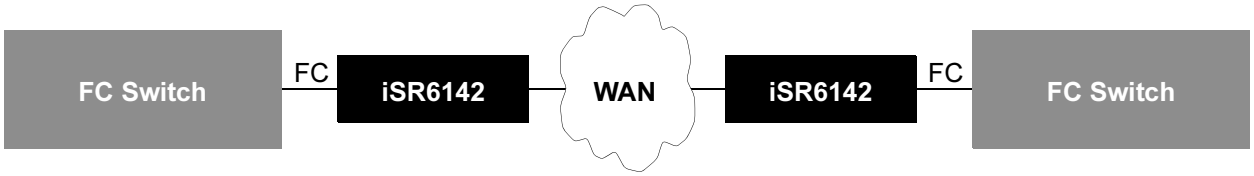

Figure 4-3. Single E_Port, Single Switches

Figure 4-4 shows dual E_Ports connecting two non-HA SANs. This configuration provides Fibre Channel link level failover protection and can yield additional bandwidth if the following conditions are met:

- The IP link between the iSR6142s can utilize the additional throughput.
- The Fibre Channel switches load balance traffic across multiple E_Ports. Check with your Fibre Channel switch vendor to verify this (most require additional licensing).

  The addition of a second iSR6142 at each site provides both link level and iSR6142 failure protection.

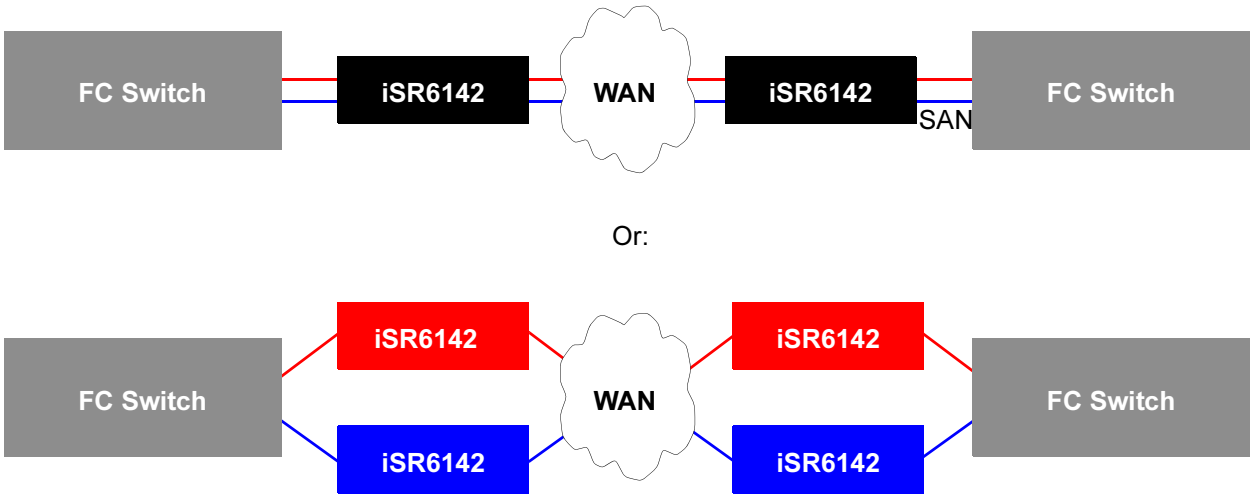

Figure 4-4. Multiple E_Ports, Single Switches

Figure 4-5 shows dual E_Ports connecting HA SANs. This configuration provides both Fibre Channel switch and Fibre Channel link level failover protection. This topology can utilize both FCIP links *without* requiring that the Fibre Channel switches E_Port load balance; that is, each Fibre Channel switch has only one E_Port. The addition of a second pair of iSR6142s makes for a fully HA environment.

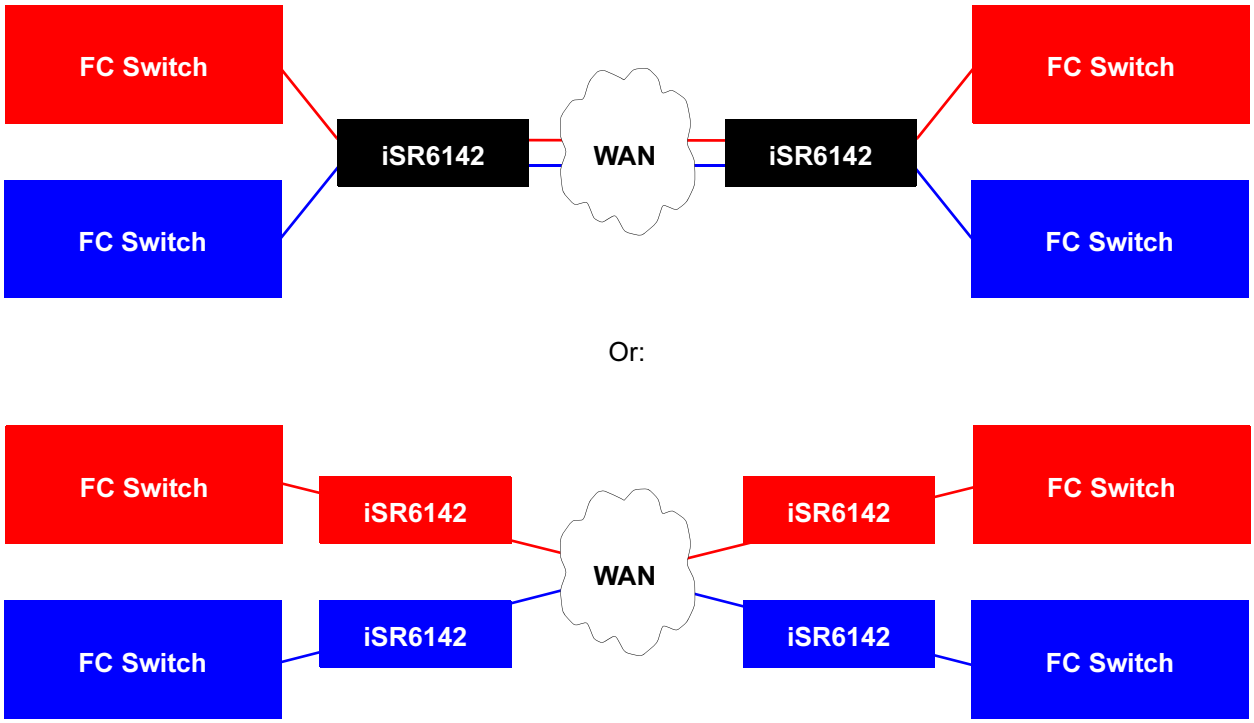

Figure 4-5. Multiple E_Ports, Multiple Switches (Full High Availability)

Document Revision History

Revision A, May 18, 2007
Revision B, May 31, 2007
Revision C, November 6, 2009
Changes
Applied new template.
Changed hardware name from *SANbox 6142* (obsolete) to current *iSR6142.*
Replaced reference to obsolete document *SANbox 6142 Intelligent Storage Router User's Guide* (FI0054601-00) to current document *iSR6142 Intelligent Storage Router Installation Guide* (SN0051102-00).
Added section titles to subdivide content.
Removed deprecated feature, full duplex link rate 10, from the Link Rates table (Table 3-1).
Added window scaling 6 and 7 to the TCP Maximum Window Size table (Table 3-2).
Added cautionary statement to the bandwidth limiting step, advising not to set the bandwidth parameter higher than the available WAN bandwidth.
Added new section, 4 Advanced Topologies, containing descriptions and drawings that illustrate advanced topologies for iSR6142 configuration with Fibre Channel over IP (FCIP).

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